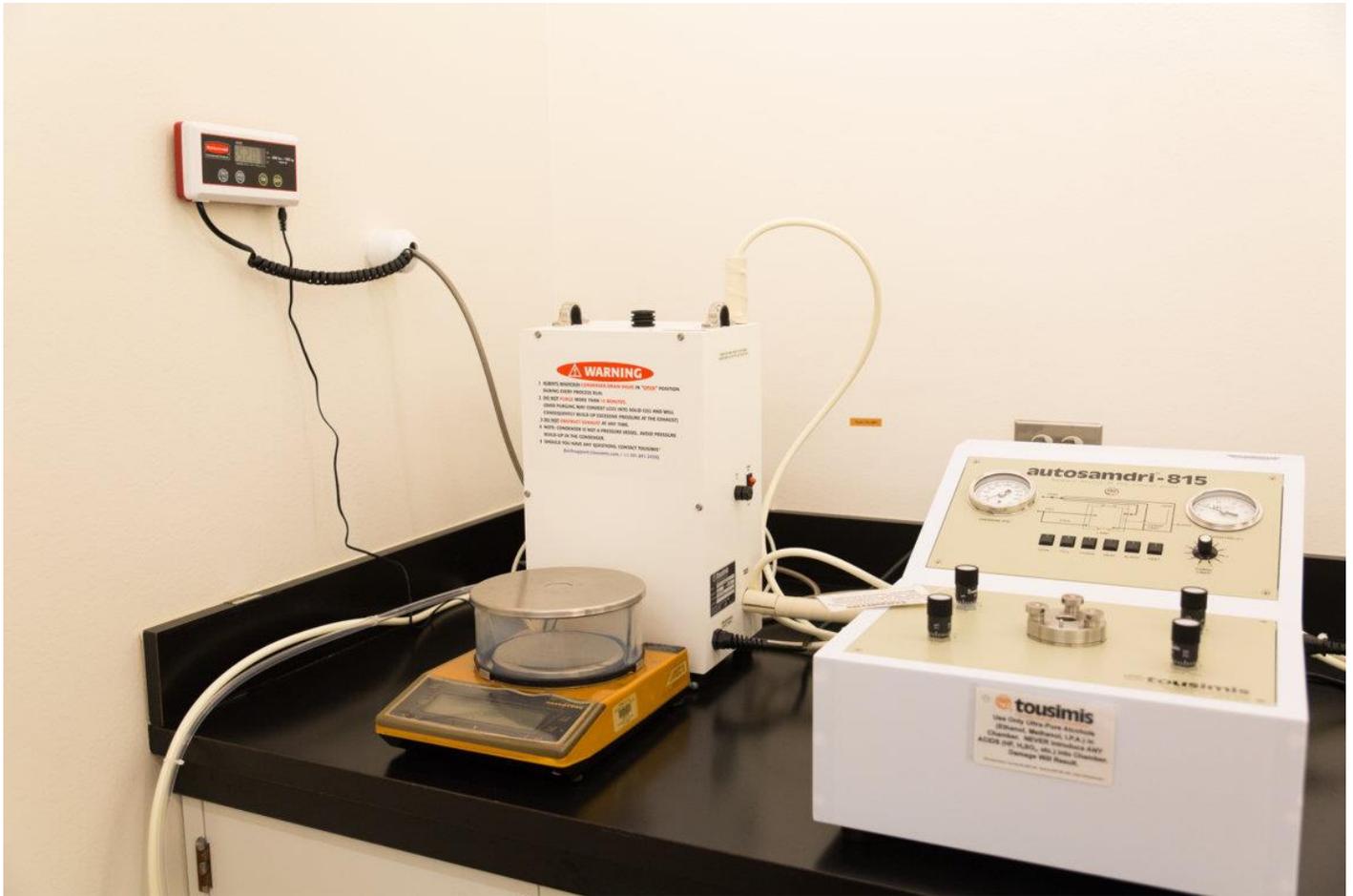


Tousimis Autosamdri-815, Series B Critical Point Dryer



The Tousimis Autosamdri-815, Series B Critical Point Dryer is an automatic supercritical point dryer that uses ultra-pure alcohols (Ethanol, Methanol, I.P.A) to achieve supercritical point drying of small wafers and MEMS devices. The CPD is used to remove liquids ensuring the samples are not damaged due to surface tension of liquids. It can also be used to produce aerogels. The instrument is able to handle up to five 10 mm dies or 1 inch diameter wafers. Only ultra-pure alcohols are allowed. Acids are not allowed since they can damage sensitive parts of the instrument.

Technical Specifications:

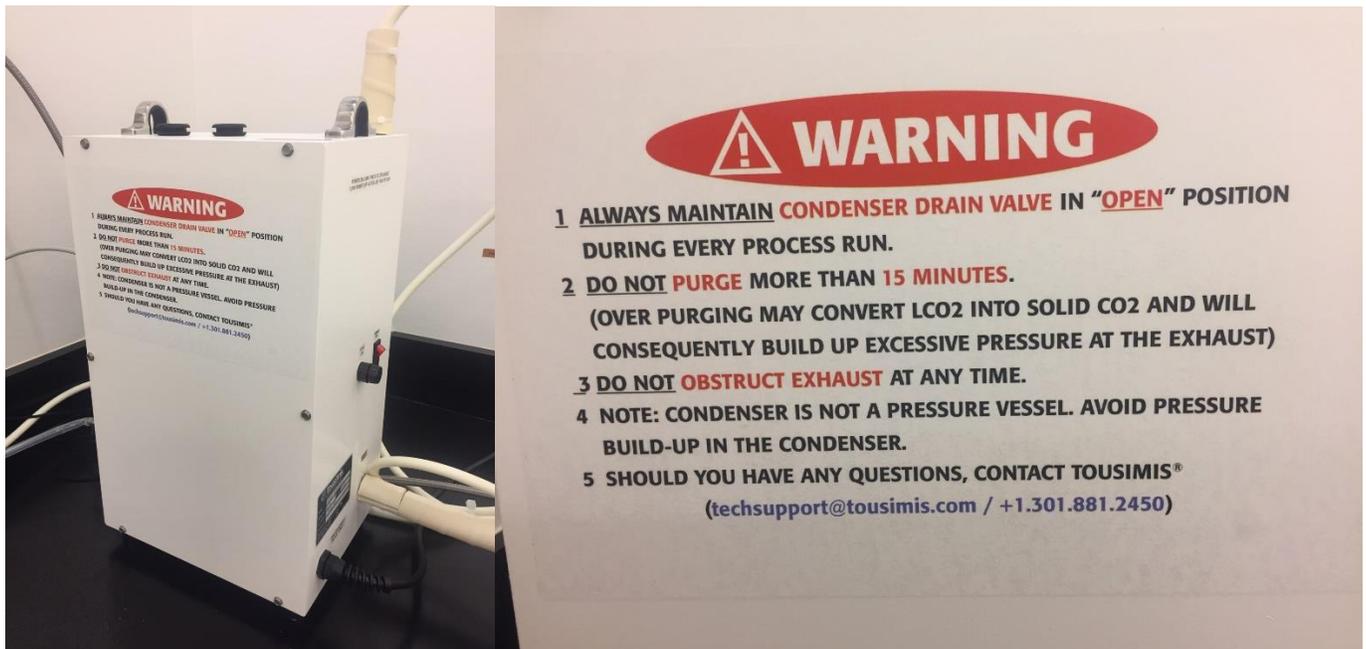
- SOTER Condenser separates waste alcohol from exhaust CO₂
- Chamber size: 1.25" (inner diameter) x 1.25" depth
- Chamber volume is 25 mL

Operation

1. Open the CO₂ located in the Service Chase 1, rm 3054D. Make sure the tank is open all the way.



2. Sign the Logbook and turn on the Condenser unit. **THE UNIT SHOULD BE ON FOR A LEAST 5 MINUTES BEFORE TURNING ON THE MAIN SYSTEM.**

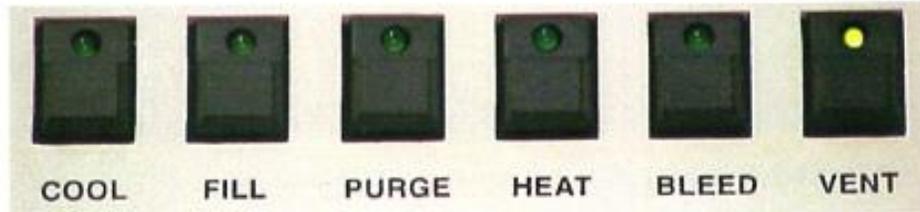


CHAPTER 3

3

Operating Autosamdri[®]-815, Series B

1. Turn power switch "ON". "ON/OFF" power switch is located on right side panel (See p.19). Green LED on VENT button will illuminate. This indicates the power is ON and the unit is "Standing By" in the VENT mode.



2. Let 815 stand for 3-5 minutes. This initial wait period will allow all internally heated plumbing components to "warm-up".



NOTE:

Pressure measurement is not indicative of the amount of LCO₂ remaining in tank. The same "PSI" reading may be noted even after the liquid CO₂ drops below the level of the syphon (aka: dip) tube.

3. All 4 metering valves (FILL, COOL, BLEED, PURGE/VENT) have been factory preset. There is no need to adjust Metering Valves. Open the main LCO₂ tank valve. The Syphon (dip-tube) LCO₂ tank should have between 25 lbs - 50 lbs (13.6 kg -23 kg) net weight of LCO₂. (Subtract the tare weight of the tank from the tank weight to get the net weight of LCO₂).

4. Pour sufficient alcohol into process chamber to cover your devices (Typically 10-15ml). Now, transfer the die holder into the open process chamber (To process 1" wafers use optional 1" Wafer Holder #8768G). Transfer either wafer or die quickly in order to avoid the device's exposure to air.

Place Chamber Lid on top of the Chamber making certain the O-Ring is in place. Follow the "chamber sealing procedure" as described on p.12-13.

10mm Die Holder and 1" Wafer Holder



10mm Square Die Holder (#8768E, Supplied)



1in Wafer Holder (#8768G, Optional)

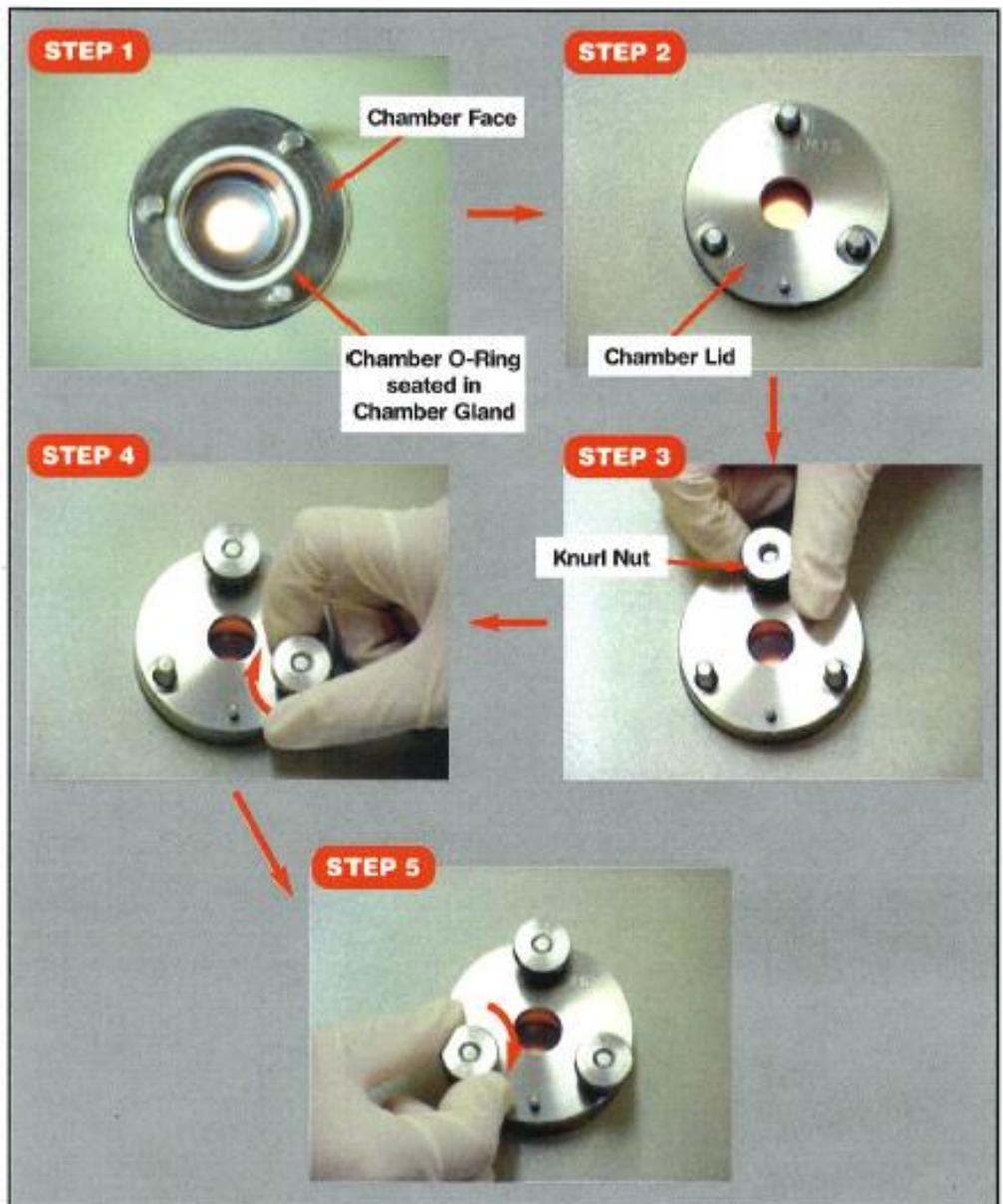
4. Open the chamber by following the directions below.

Chapter 2

Closing Autosamdri[®]-815 Process Chamber

Chamber Sealing Procedure

1. Prior to placing chamber lid onto chamber, be sure that o-ring and surrounding chamber surface is clean and moisture free (NO Grease).
2. Carefully align chamber lid holes over chamber posts and slowly lower onto chamber face.
3. Carefully place the 3 knurl nuts onto each appropriate chamber post and turn in a clockwise direction until flush with chamber.



Securing Autosamdri®-815 Chamber

4. Insert the Pin Spanner (#8770-58) Tool into the side hole of each knurl nut and gently snug each knurl nut firmly in a clockwise direction.



NOTE:

Never scratch the chamber viewing port window - this could weaken it and may cause it to crack under pressure. Before you insert the Wafers/Die, inspect the chamber for cleanliness and dryness - The chamber face must be moisture free prior to sealing lid.



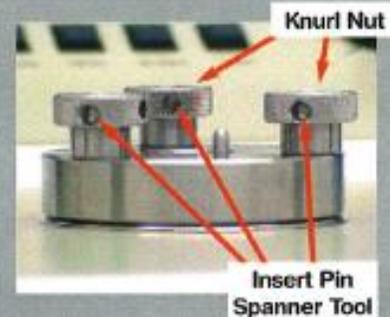
NOTE:

There is no need to over-tighten knurl nuts with Pin Spanner Tool. Only firm gentle force required to make seal.

DO NOT OVER_TIGHTEN OR USE ANY ALTERNATIVE TIGHTENING TOOL.



Pin Spanner Tool (# 8770-58)



STEP 6



STEP 7



STEP 8



5. Chamber is now secure and ready for initiating a process run as per the following operational procedures listed p. 14.

NOTE: THE USER MUST STAY AND MONITOR THE SYSTEM DURING THE ENTIRETY OF OPERATION.

Chapter 3

Setting Purge Timer



NOTE:

Actual Purge Time can vary greatly depending on your sample type in combination with the FILL and PURGE metering value adjust positions.

5. Once the chamber lid is secured, it is time to set the PURGE timer located to the right of the push button switches (See picture below).

Positions on the purge timer are calibrated at 5-minute intervals. Setting the "purge timer" indicator arrow to the #1 position will give you a 5-minute purge time. The #2 position will give you a 10-minute purge time... Correspondingly, the #9 position will give you the maximum purge time capable of 45 minutes.

The "Purge Time" setting is best determined by the individual process engineer. General Purge Time guidelines for various chamber alcohol levels within the 815 are the following:

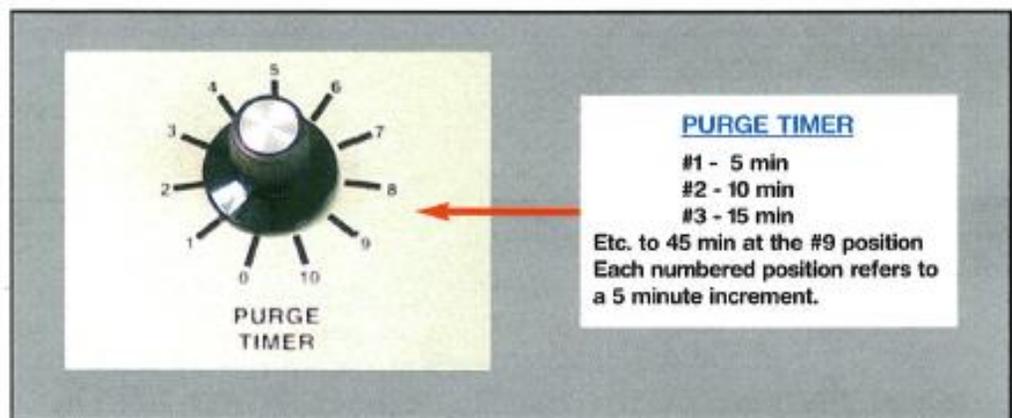
- $\frac{1}{4}$ chamber = 5 minute purge time
- $\frac{1}{2}$ chamber = 7 minute purge time
- $\frac{3}{4}$ chamber = 10 minute purge time

Setting Purge Timer

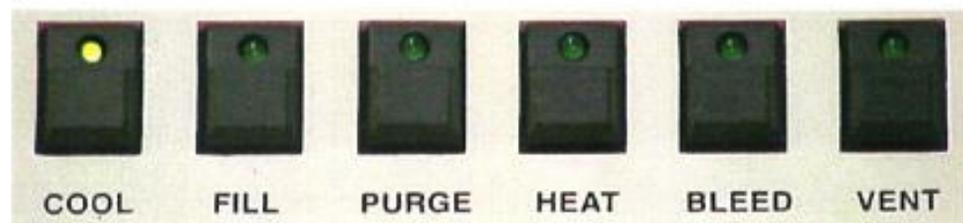


NOTE:

Generally, Position #2 (10 min) is sufficient for the majority of process scenarios in the Autosamdri®-815, Series B

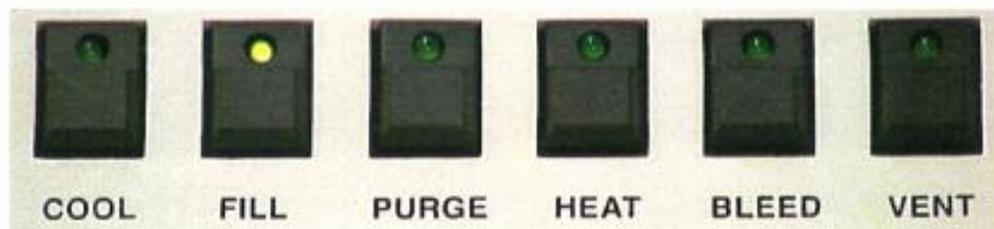


7. After initial warm up, press the COOL button. The COOL LED light will go on, and the VENT light will turn off. As the chamber temperature slowly begins to drop, you may hear the LCO₂ circulating through the unit. The 815 will continue cooling by itself until the chamber temperature reaches 0°C (±5°C). At this cut off point, the cooling will automatically stop.

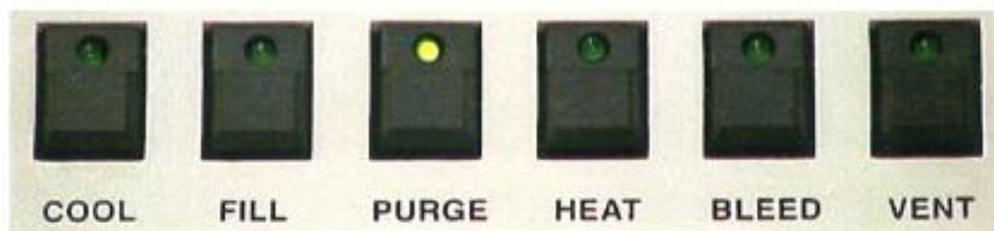


Chapter 3

8. Press the FILL button and the 815 will begin to fill the chamber with LCO₂. *From this point forward, the Autosamdri®-815, Series B will automatically advance through all process modes sequentially until completion.* During the FILL mode, the LCO₂ will enter and fill the process chamber for 2 minutes. You may hear the COOL cycle ON/OFF during the FILL mode as the chamber temperature is automatically maintained below 10°C. This is normal.



9. After the 2 minute FILL mode expires, the 815 will automatically advance into the PURGE mode. This mode will be indicated by the illumination of the PURGE LED.



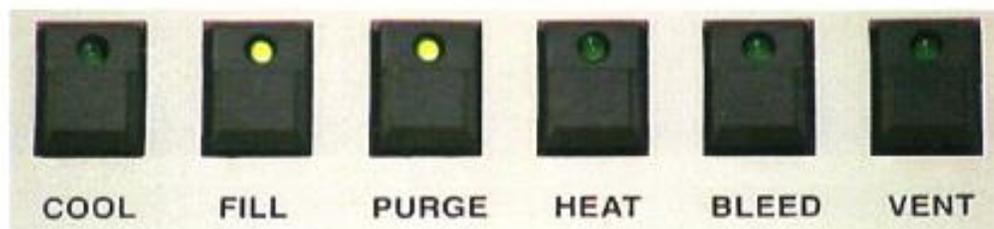
10. At this point of the cycle, the 815 will remain in the PURGE mode for the duration of time pre-set by the operator via the PURGE TIMER (See p.15). The waste alcohol will exit the 815 Chamber via the Exhaust Connect into the SOTER™ Condenser.



NOTE:

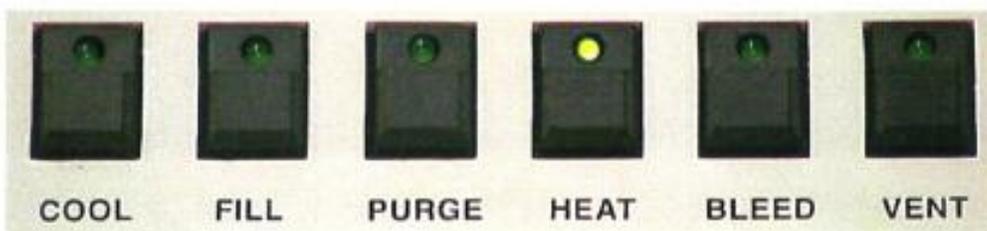
SOTER™ Condenser Drain Valve should always be maintained in the "OPEN" position during the process run, except when relocating Condenser or emptying Carboy.

11. Upon Completion of the PURGE mode, the unit will automatically advance into a POST-PURGE-FILL mode in which the chamber fills with LCO₂ for an additional 2 minutes. This mode is indicated by both the FILL and PURGE LED's illumination.



Operating Autosamdri®-815, Series B

12. Upon completion of the POST-PURGE-FILL mode, the PURGE and FILL LEDs will turn off and the HEAT LED will illuminate. The HEAT mode is the stage in which the samples are carried through the "Critical Point". Both the pressure and temperature will steadily rise. (See Check-Out Data Sheet in the appendix of your 815 User Manual)

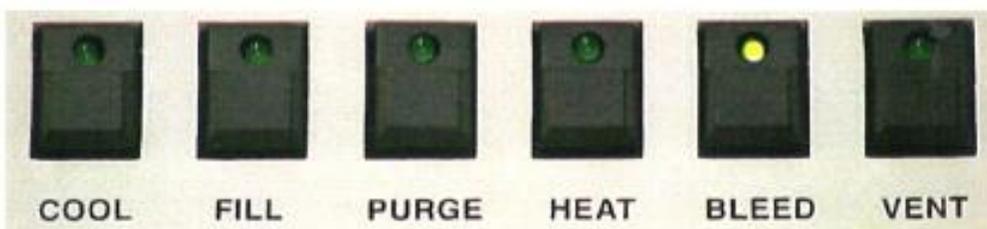


13. When the chamber pressure reaches and goes beyond 1072 psi, it will stabilize in the range of 1350psi ($\pm 5\%$ @ 20°C). As the temperature achieves 31°C, the unit has achieved the "critical point" and this is where the 'tousimis equilibrium'* cycle starts. The HEAT LED will begin to blink for the next 4 minutes indicating your 815 is in the 'tousimis equilibrium'*.



* 'tousimis equilibrium' is the point during the critical point passage in which both the pressure and temperature are maintained above the critical point within the chamber for a period of 4 minutes prior to advancing into the BLEED mode.

14. At the end of the 'tousimis equilibrium' period, the 815 will automatically advance into the BLEED mode. The HEAT LED will stop blinking and the BLEED LED will illuminate.



15. At this point, you can measure the BLEED rate (if desired) via the 20 SCFH Flow Meter (See p. 24) supplied, by attaching the Flow Meter to the outlet of the COOL / BLEED EXHAUST. The BLEED rate has been factory pre-set to decompress the chamber at a rate of 100-150psi/min.

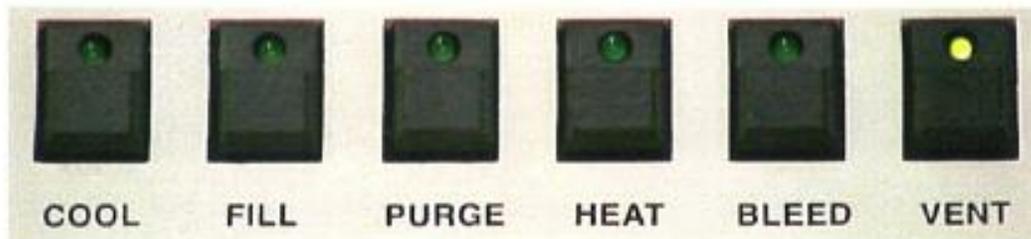


NOTE:
BLEED flow rate may be periodically checked by attaching 20 SCFH Flow Meter to COOL/BLEED CO₂ Exhaust Outlet. Measure flow rate at onset of BLEED Mode.

The flow rate should read 8-15 SCFH at the onset of the BLEED mode. This setting should yield an average decompression rate of approximately 100-150psi/min reduction in pressure. This pressure reduction flow rate is the desired decompression rate between 1300psi to 400psi.

16. At approximately 360-400 psi, the 815 will automatically advance from BLEED mode into VENT mode. The BLEED LED will turn off, while the VENT LED will illuminate.

Chapter 3

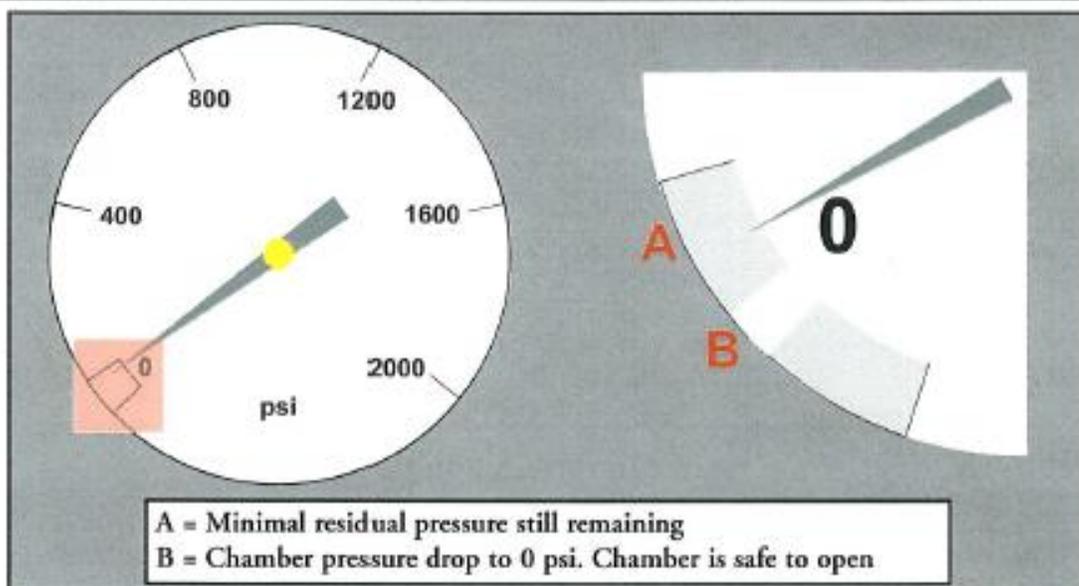


17. It is not necessary to re-adjust the PURGE-VENT metering valve flow rate. The chamber should then come to atmospheric pressure after approximately 3 minutes in this VENT mode.

18. At this point, the chamber lid may be removed by alternatively and evenly loosening the knurl nuts (Pressure Gauge should be in the 0 psi range, Never attempt to 'force' opening).

19. The sample(s) can then be removed from the chamber for further processing. Seal the chamber with the lid to help keep it clean and moisture free.

Pressure Gauge (0 psi)



20. Turn the 815 power OFF using the ON/OFF SWITCH located on the right-hand side of the 815 (See p.19). You will notice that it will take a few seconds for the VENT LED to turn off via gradual light fade. This is normal.

21. Turn SOTER™ Condenser Power OFF.

22. Turn LCO₂ main tank ON/OFF valve OFF in a "Clockwise Rotation" if desired for additional safety precaution.

5. Open the lid and remove your sample. Replace the lid. Tighten the nuts with your hands only.

6. Close the CO₂ located in the service chase. Make sure the tank is closed all the way.

TROUBLESHOOTING

If you notice the following, please contact the NCF main office. The CO₂ tank needs to be changed.

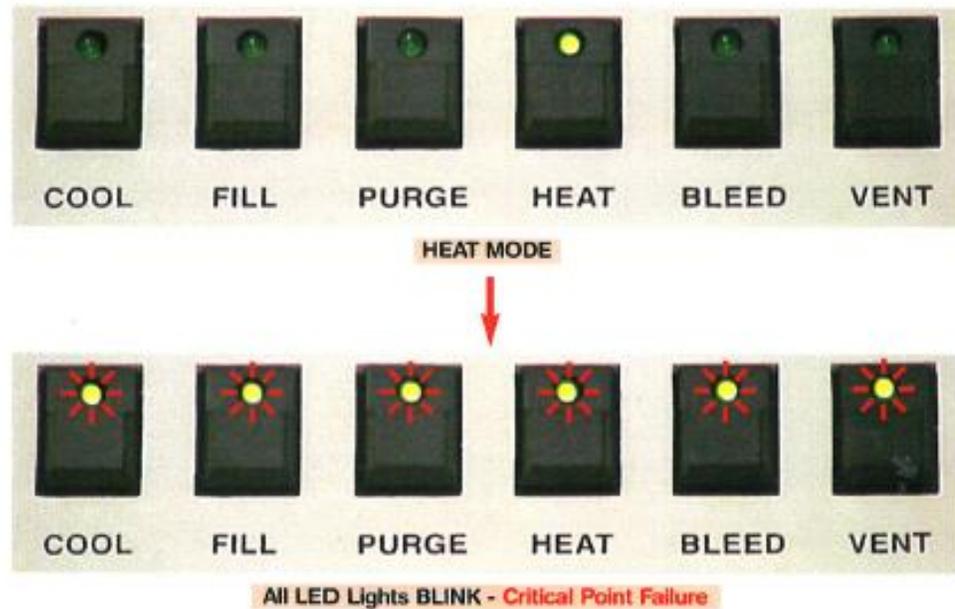
Appendix C

Critical Point Failure Correction



All Green LED Lights Blink

Symptom: During HEAT mode, all Green LED's of the Autosamdri® (Automegasamdri®) begin to blink.

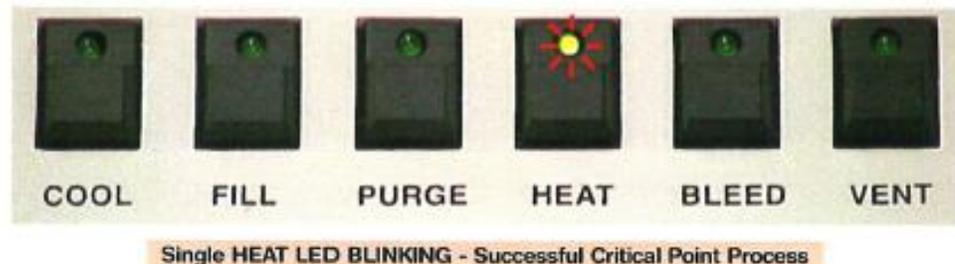


NOTE:

The typical Critical Point Failure is caused by the pressure has not reaching the pre-set 1200 psi in the process chamber. The overwhelming reason for Critical Point Failure is due to insufficient LCO₂ remaining in the LCO₂ tank.

Description: The All LED Blinking Symptom indicates that the Temperature and/or Pressure in the the process chamber has not reached the Critical Point in the proper sequence during HEAT mode.

Background: The system indicates a successful Critical Point run when the lone HEAT LED blinks ON/OFF by itself as indicated in the picture below:



A successful Critical Point process is achieved when the internal micro processor receives the following two signals in this sequence:

1. Pressure Signal sent via High Pressure Sensor @ 1200 psi.
2. Heat Signal sent via Heat Thermostat shutting "OFF" typically between 34-38°C

Critical Point Failure Correction

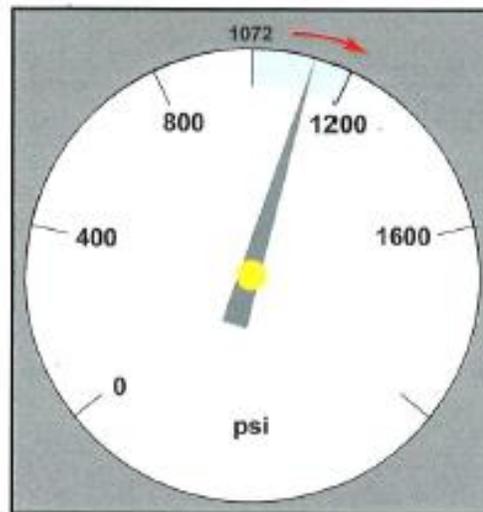
Critical Point Failure Correction Options:

Provided the micro processor receives the signals in the above sequence, there will not be a 'Critical Point Failure'.

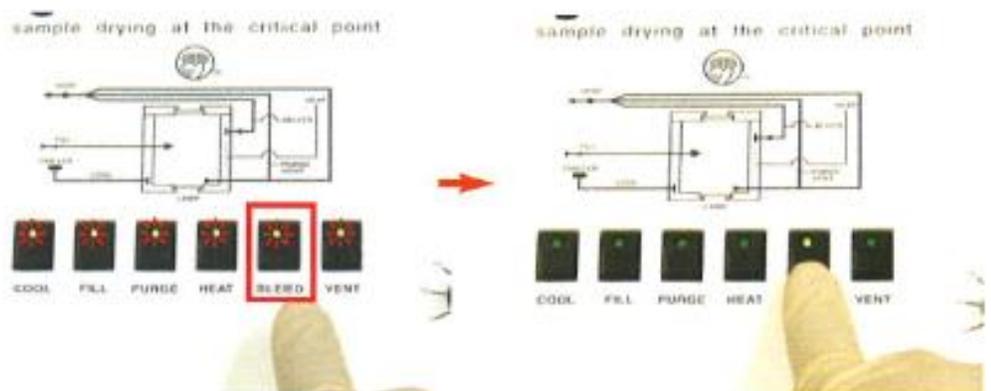
However; should the micro processor receive these signals in the reverse order ... Heat Signal (1st) followed by Pressure Signal (2nd) ... a failure will be indicated via all the LED's blinking.

Solutions:

Scenario #1: Pressure is greater than 1072 psi.



Press BLEED button.



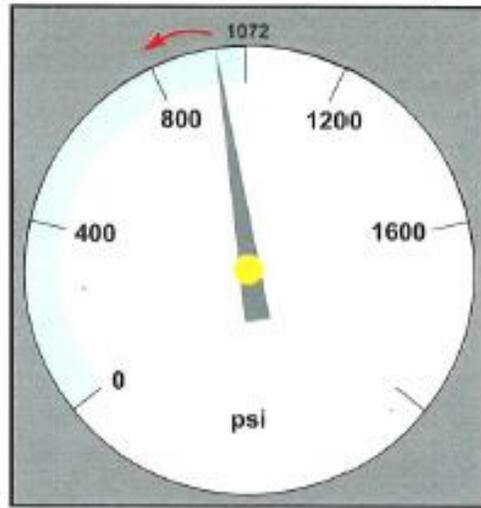
All blinking LED's will turn OFF, system will default back to to the normal Auto-Operation mode and resume in BLEED mode moving on to completion as per normal.

The LCO2 tank should be replaced with a new LCO2 tank prior to commencing the next process run.

Scenario #1 may be deployed as the theoretical physical completion of the critical point (1072psi + 31C) for CO2 has been attained even though the system's sensors did not detect it. The system's sensors are designed to over-shoot both these pressure and temperature minimums for CO2 critical point.

APPENDIX C

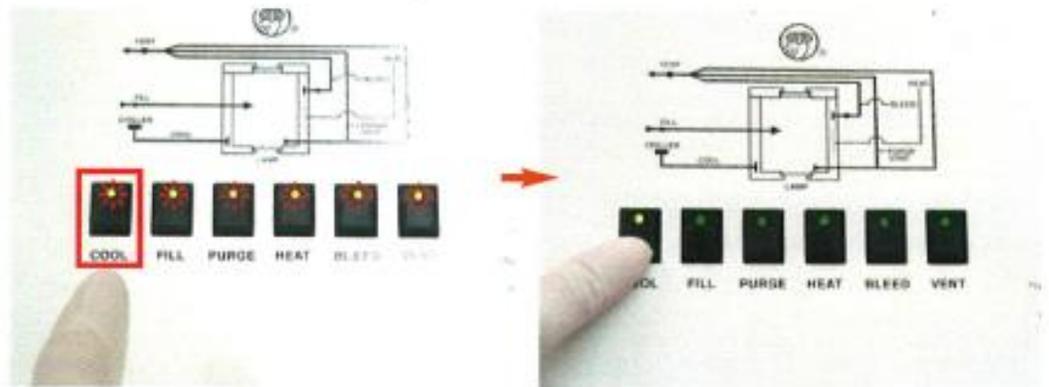
Scenario #2: Pressure is less than 1072 psi.



Replace LCO2 tank with a new LCO2 tank.

DO NOT OPEN CHAMBER AT THIS POINT
MAINTAIN SAMPLE PRODUCT WITHIN PROCESS CHAMBER.

Press COOL button to re-initiate the process.



Press FILL button as per normal initiation of a new process run.

